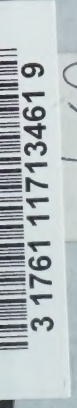


Energy efficiency in Canada

Background Paper BP-304E

ENERGY EFFICIENCY IN CANADA

Peter Berg
Economics Division

September 1992

Library of Parliament
Bibliothèque du Parlement

Research Branch

The Research Branch of the Library of Parliament works exclusively for Parliament, conducting research and providing information for Committees and Members of the Senate and the House of Commons. This service is extended without partisan bias in such forms as Reports, Background Papers and Issue Reviews. Research Officers in the Branch are also available for personal consultation in their respective fields of expertise.

Available in Canada through
your local bookseller
or by mail from
Canada Communication Group -- Publishing
Ottawa, Canada K1A 0S9

Catalogue No. YM32-2/304E
ISBN 0-660-14836-6

CE DOCUMENT EST AUSSI
PUBLIÉ EN FRANÇAIS

TABLE OF CONTENTS

ENERGY EFFICIENCY IN CANADA

INTRODUCTION

The attention of energy policy-makers in Canada and throughout the world has once again shifted to the demand side of the energy equation. The rebirth of the focus on energy demand has not stemmed from concerns about security of supply or energy costs, neither of which is a dominant current issue, but almost exclusively from concern about the environment. One can in fact make a strong argument that recent energy policy-making has been consumed by environmental issues.

While acid deposition and ground level ozone represent formidable environmental challenges for the energy sector, the most complex and vexing issue is global climate change. Given that energy production remains heavily biased towards fossil fuels, the leading emitters of carbon dioxide and other greenhouse gases linked to changes in climatic conditions, emphasis is again being placed on reducing our consumption of such fuels. It is recognized, however, that in the short term, there is only limited opportunity for us to shift to alternative fuels; this leaves energy efficiency as the most promising immediate way of dealing with these environmental challenges.

Historically, firms have responded to energy price increases by introducing and applying cost-effective new technologies and processes to curb energy demand. Consumers have also reduced energy demand, particularly in transportation and housing. As this paper will show, the Canadian record in this area is indeed favourable, when one takes into account our industrial structure, climate, and geography.

When the price of energy has risen significantly, as it did in several instances of "price shock" in the 1970s, businesses and individuals substituted capital for energy in the form

of energy conservation measures. They continue to do so in cases where economic analysis of a given investment indicates that this substitution is in their competitive interest. This is precisely how the marketplace, with its focus on effective price signals, is designed to operate.

The existence of low real world oil prices, together with the emergence of an internationally diverse supply "pool," has served in more recent years to lessen the urgency of energy conservation. While the energy pricing environment in the 1990s is not nearly as conducive as it once was to investments in cost-effective energy efficiency, the opportunities for significant positive performance in this area have been demonstrated. A number of barriers may be preventing those opportunities from being realized. If environmental objectives are to be achieved through improved energy efficiency, these barriers must be removed.

THE CONCEPT OF ENERGY EFFICIENCY

It should first be made clear that the term "energy efficiency" does not refer to the curtailment of our use of energy services such as heat, light and mechanical power in order to ensure future energy supplies or to lessen environmental impacts. Instead, the drive towards greater efficiency of energy use is motivated by the desire to minimize the amount of energy used to produce a given amount of output.

This definition does not take into account the important factor of cost; while technically correct, it does not integrate the notion of economic efficiency. While it is entirely possible that energy inputs could be minimized, to some technologically limited lower level, how economic would such an investment in energy-saving technology be? What would be the capital costs? It is important to understand that energy efficiency and economic efficiency are not identical. While some efficiency gains could be technically within reach and result in reduced energy consumption, they might not be economic and would be achieved only at the expense of overall economic growth.

The demand for energy is a derived demand. Energy is demanded by firms and consumers not for itself, but for the services that it provides. Given that it is the services that are being targeted and not the primary energy sources, economic agents have an incentive to substitute capital for energy to provide these services. For example, insulation can replace a

given amount of energy to meet a portion of a homeowner's heating needs. In the industrial sector, improvements in electric motors can also serve to reduce electricity demand.

What degree of investment in energy efficiency is economic? Two types of decision-making criteria apply.[1] From society's point of view, the answer is that investments in energy efficiency remain economic up to the point at which the marginal benefit of saving a unit of energy is equal to the social opportunity, or long-run marginal cost of the energy which is substituted for. Any investment made where the returns could not cover the social opportunity costs of the energy form displaced would not be economic and should thus not be undertaken.

From a strictly private decision-making perspective, decisions would be made on the basis of expected market rates of return and market energy prices. Generally speaking, the calculations undertaken are rather simple, involving the calculation of undiscounted paybacks. Some firms, however, do use criteria such as discounted present value and internal rates of return to determine the relative merits of certain energy efficiency investments.

The concepts of energy efficiency (with no cost component attached) and economic efficiency are thus different, and can be at odds with each other.[2] Firms base their production decisions on economic efficiency, whereby an attempt is made to minimize the total costs of all inputs to the production process. If the price of energy inputs is low, satisfying the economic efficiency objective may involve employing more of the energy input instead of more expensive labour or capital inputs. If the energy-efficient process was selected, with a substitution of capital for energy, the goal of economic efficiency would be forfeited since the total costs of production would be higher.

This latter interpretation of the concept of efficiency is the one relevant to this discussion. Economic efficiency in the use of total inputs is what firms attempt to maximize. Production processes that do not display energy efficiency, but satisfy economic efficiency requirements, should thus not be seen as wasting energy resources.

---

(1) Energy, Mines and Resources Canada, *Economics of Energy Conservation in Canada*, Economic and Financial Analysis Division, 1984, p. 5-6.

(2) Michele McLachlan and Imad Itani, *International Comparisons: Interpreting the Energy/GDP Ratio*, Canadian Energy Research Institute, Study No. 41, December 1991, p. 7-8.

THE RATIONALE FOR ACHIEVING EFFICIENCY GAINS

Improved efficiency in the use of energy resources, if realized in a sound manner, can provide a number of important economic benefits to firms and environmental advantages to society at large. There is, for instance, no question that energy efficiency investments that are cost-effective make sound economic sense for both businesses and consumers. Canada uses energy intensively in its industrial and agricultural sectors. Competitiveness can therefore be improved significantly if the operating costs for industry are lowered through adoption of energy-efficient processes. Many industrial end-use applications offer quick paybacks, and firms could improve their profits by seizing these cost-saving opportunities. Alternatively, businesses could employ the savings generated by enhanced efficiency for investments and thus improve long-term growth prospects.

Consumers also have an important financial incentive to invest in energy efficiency. The return on investments in lighting, heating and other end uses will often return important energy cost savings over a relatively long period of time. For many currently available commercial applications, the initial investment is paid back more quickly.

While it has been common knowledge for some time that energy efficiency improvements could help personal and corporate budgets, their contribution to reducing environmental problems such as acid rain, smog and global warming through a decrease in emissions has been emphasized only recently. In particular, it is accepted by many that climate change resulting from global warming represents today's most pressing environmental issue. Energy efficiency can contribute to efforts to slow climate change. The reduction of demand for fossil fuels (either at the primary or secondary levels) can lower atmospheric emissions at costs which are often below those of projects designed to generate energy.

While there is not a one-for-one relationship between energy intensity and the level of greenhouse gas emissions, a strong relationship does exist. Our poor standing amongst

the industrialized countries both in terms of energy intensity and emissions (especially CO_2) will lead to increasing pressure from both the public and our international partners.[3]

Efficiency improvements can also be of benefit in that they can affect the timing and the extent of new energy developments, thereby reducing the environmental degradation associated with developing, processing and using that energy. Progress in this area would also help to resolve other environmental problems, such as acid rain and ground level ozone.

Finally, from a financing point of view, large-scale energy projects are inherently riskier than efficiency improvements in that they typically involve large sums of capital and are characterized by substantial cost escalation. The small-scale, short lead times and quick payouts typically associated with energy efficiency investments render them an attractive alternative. Undoubtedly, increased energy efficiency can offset the need for additional energy production, at considerable cost savings.

THE DOMESTIC PERFORMANCE

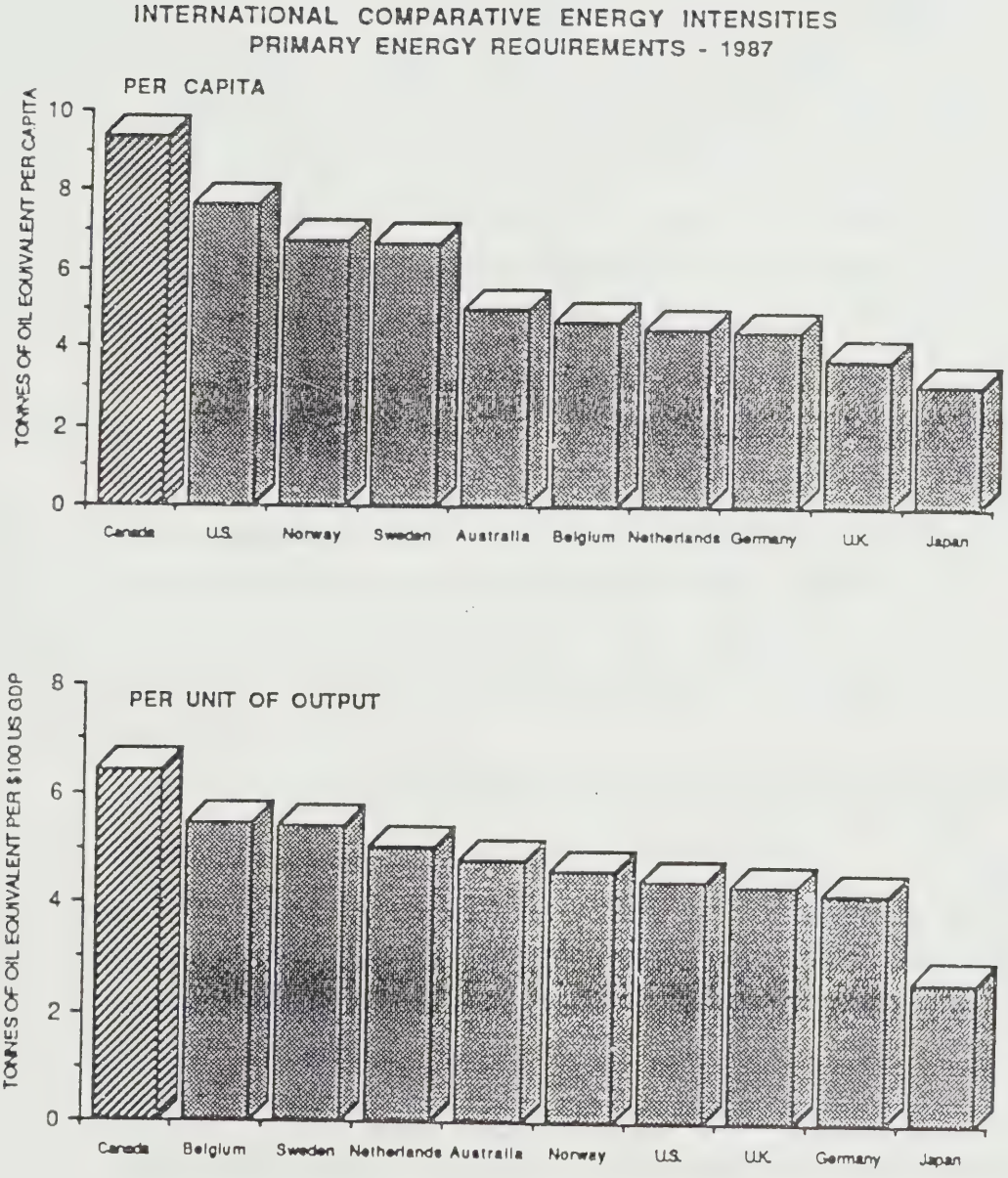
When considering energy intensity, usually estimated in terms of energy consumption per capita or per unit of economic output, Canada's performance ranks as the worst among the major industrialized countries. On a per unit of Gross Domestic Product (GDP) basis, Canada is currently the largest major user of energy in the world. Figure 1 compares our performance, using both of these measurements, with that of a select number of other countries.

That Canada is an energy intensive country is beyond dispute. As a recent EMR discussion paper points out, there are sound reasons for this: a cold climate, leading to more significant space heating requirements; a relatively low population density, causing more energy to be used in transportation; the existence of large and comparatively inexpensive stocks of energy resources with low production costs, enabling energy prices to remain at relatively low

---

(3) Minister of Energy, Mines and Resources Canada, Notes for a speech to the Petroleum Joint Venture Association, 6 March 1991, p. 5.

Figure 1



Source: Energy, Mines and Resources Canada, *Energy Use and Atmospheric Change*, August 1990, Figure 2.1, p. 8.

levels; and the resultant high proportion within Canadian industry of energy-intensive goods, such as iron and steel, aluminum, pulp and paper, chemicals and cement.[4]

Canadians may be extremely intensive users of energy, but one cannot automatically infer that they are inherently wasteful in their use of this resource, or energy inefficient. In fact, the two concepts are quite different, in that while changes in energy intensity may be affected by changes in energy efficiency, they also may reflect shifts in the mix of domestic output to less energy intensive activities (i.e., changes in industrial structure).

Canada's dependence on natural resource industries for exports and wealth has, in the main, precluded it from making sudden structural shifts in industrial output to less energy-intensive industries. While there is certainly room for improvement, our comparative energy efficiency record in various industrial processes has in fact been quite favourable. There is thus little need for expensive measures to foster greater energy efficiency beyond what is economic.

Energy efficiency can be categorized as the amount of energy required to perform a given task, such as heating a home to a certain temperature, or driving a vehicle 100 kilometres. As soon as one aggregates the individual efficiency calculations into a single measurement, using output in constant dollars rather than in physical units, or one adds the outputs of a number of industries together in the denominator, one is capturing more than just the effects of energy efficiency.

Another element that injects a flaw into comparative analyses of energy efficiency performance is their use of a common currency, typically the U.S. dollar. The problem arises because sizeable changes in exchange rates render the international comparison for a given year decidedly less than useful. While the problem can be avoided by placing energy use in per capita terms rather than in relation to GDP, energy use per capita is still not an accurate indicator of efficiency.

Energy efficiency was not a major national concern prior to the early 1970s. Energy was abundant and inexpensive. The 1973 oil price shock and concern over security of supply brought greater prominence to the question of energy efficiency. However, our

---

(4) Energy, Mines and Resources Canada, *Energy Use and Atmospheric Change*, Efficiency and Alternative Energy Branch, August 1990, p. 7-8.

improvement in performance throughout the remainder of the decade did not match that of other industrialized countries. This was largely due to the fact that the domestic price of oil and gas was artificially held below world levels, thus preventing the price mechanism from working to prompt energy users to seek more efficient ways to use the energy resource. Moreover, we had relatively inexpensive alternatives to oil, namely natural gas, coal and electricity.

Our progress in improving energy efficiency has, however, been more rapid since 1979, the time of the second international price shock. Energy demand in Canada declined in absolute terms in the early 1980s. Our energy use per unit of output also fell dramatically during the decade, matching the performance of other industrialized countries such as the United States and Japan.

Many of these realized increases in energy efficiency reflect shifts in the underlying structure of the economy, away from energy-intensive activities such as heavy industry and towards the service sector and light manufacturing. More than half of the efficiency improvement in the last 20 years, however, reflects the incorporation of more energy-efficient technologies and behaviour within given sectors of the economy. Increases in energy prices prompted consumers and industrial users of energy to become more efficient. Improvements in technology enhanced the willingness of consumers and firms to invest in energy-saving devices. Federal and provincial governments also played a significant role by implementing subsidy programs and regulating tougher gasoline consumption standards, both of which promoted energy conservation.

Growth in energy demand resumed in the second half of the 1980s and there is some evidence of a decline in the rate of energy efficiency improvements during that period, particularly in the automobile market. As was noted above, the public is also now considerably less preoccupied with the security of energy supply.

While Canadians remain the industrialized nations' highest per capita energy users, the intensity of energy use - the amount of energy required to produce one dollar of GNP - has decreased noticeably since the 1970s. Whereas in 1973, every dollar of output required

23 megajoules of energy, by 1989 it required only 17 megajoules, representing a 1.5% annual average decline in energy intensity over this period.[5]

Our comparative performance internationally was not nearly as favourable. In the period 1970-88, for instance, energy use per GDP in Canada dropped by 1.3% per year, compared with an average rate of decline within IEA countries of some 1.6%. But as EMR's discussion paper notes, much of the reason for this poorer performance lies in the fact that it was often more economical to substitute other sources of energy (e.g., natural gas, electricity) for oil than to enhance energy efficiency.[6] Essentially, our wide variety of energy sources was precluding us from putting in place the energy-saving initiatives that other countries, less well-endowed in energy resources, were implementing.

BARRIERS TO IMPROVING THE EFFICIENCY OF ENERGY USE

While there is no question that a number of applications offer tremendous opportunities for improving energy efficiency, many of these may not be fully employed owing to barriers that inhibit an appropriate level of investment (i.e., the best level from an overall social perspective) in energy efficiency.

One of the barriers most commonly cited is the failure of prices to reflect the full costs of production. Economic theory suggests that market forces will lead to an optimal allocation of resources, but only if the market operates properly. However, the achievement of a "level playing field," a necessary prerequisite for efficiency in resource allocation, remains elusive. Federal and provincial governments continue to favour certain supply options with subsidies and favourable tax policies; provincial policies can provide financial benefits (e.g., guarantees of debt, exemption from payment of corporate income tax, preferential borrowing rates) to the publicly-owned electric utilities. While the gap between prices faced by decision-makers, and the true costs of energy, have narrowed in recent years, a number of pricing

---

(5) Minister of Energy, Mines and Resources Canada (6 March 1991), p. 2.

(6) Energy, Mines and Resources Canada (1990), p. 8-9.

discrepancies remain. In this environment, the ability of firms in the energy efficiency business to compete with the traditional forms of energy is hampered.

Another pricing barrier results from the fact that the production, distribution and consumption of energy often entail environmental costs that are not integrated into the final price at the consumption stage; they in essence represent an implicit subsidy to energy consumers. The existence of these inappropriate pricing policies may stimulate an over-consumption of energy resources that is undesirable from society's point of view.

Insufficient information can also hamper efforts to improve energy efficiency. According to EMR's discussion paper on climate change, buyers of equipment, vehicles or buildings (manufacturers, consumers, consulting engineers, and financial institutions) are in many cases not aware of alternatives that are more energy efficient and/or are unaware of the financial benefits that may arise from using these. In other cases, potential buyers may know of the technologies but may perceive them as unproven and thus risky.

Finally, there are also institutional constraints to appropriate energy use. Products (e.g., compact fluorescent lights) and systems may have been shown to be useful, but may not be available in retail establishments. Builders and manufacturers sometimes take into account only initial costs, as opposed to life-cycle costs, when building facilities for rent or lease. The result can be a loss of long-term energy savings. Replacement of the physical capital stock (i.e. changes in machinery and fixed plant; house construction) is a lengthy process, which inhibits progress in enhancing energy efficiency because consumers and managers are required to assess the relative cost of energy-efficient substitutes only at the time of replacement.

There are also limited numbers of trained construction trades that implement energy-saving measures in residential housing. This constraint serves to limit, in the short run, the rate at which the potential can be captured.

One of the biggest obstacles is the initial capital cost associated with energy-conserving investments. While this can be eventually recovered through the subsequent savings in energy, the up-front sunk capital cost can be enough to deter potential investors (as well as lenders). Consumers have a tendency to over-emphasize the up-front costs of these investments, rather than the financial gains which can be made over the life of the investment. By attaching a less than optimal present value to the stream of future benefits, consumers tend to under-invest

in energy efficiency. There is also concern that firms tend to evaluate energy efficiency investments against more stringent criteria (i.e., paybacks, rates of return) than they use for other capital investments.

Finally, investment in energy efficiency in the residential and commercial sectors is sometimes plagued by a lack of clear incentives. For example, because landlords can pass on higher energy costs to tenants, they have little incentive to invest in insulation or improved heating efficiency. Investment by tenants is also constrained because they are unable to recoup benefits in a short period, the length of most rental contracts.

THE ROLE OF GOVERNMENT

Economic theory suggests that the market will be interested in adopting new technologies that are cost-effective. However, because of the barriers described above, the desired market response may not be forthcoming. It has therefore been argued that the government has a role to play in reducing the barriers to efficient energy use and thus encouraging energy efficiency. There is some debate, however, over the extent of this involvement, and the costs associated with sizeable intervention. Much of the debate involves ideological underpinnings and cannot be easily resolved; a significant contribution can be made by the public sector, however, without fundamental disagreement.

A brief review of government's past involvement is useful. Historically, energy conservation programs designed to improve energy intensity have been undertaken by both the federal government and the provinces. Following the 1973 oil crisis, the federal initiative concentrated on providing information (e.g., labelling of household appliances), tax incentives to permit accelerated write-offs on the purchase of specific energy-conserving equipment, and efforts to enhance in-house energy efficiency.

Regrettably, the success of these ventures was hampered considerably by the fact that domestic oil and gas prices were not allowed to rise to international market levels. As a result, consumers and manufacturers were less interested than they would otherwise have been in making investments in efficiency. Rather than allowing domestic prices to rise to world levels, as economic theory would have dictated, the federal government introduced a number of

costly subsidy programs (e.g., Canadian Home Insulation Program, initiatives undertaken as part of the National Energy Program) to deal with the poor price signal and lack of information and technological development, and ultimately to stimulate investment in energy saving projects.[7]

The fall in world price levels in the early 1980s rendered these grant programs increasingly less effective. At the same time, the federal government committed itself in 1984 to fiscal restraint and made grants for energy conservation one of the first casualties. Not anxious to vacate the field entirely, yet eager to replace the previous grant-based system, the government in 1985 initiated the National Conservation and Alternative Energy Initiative (NCAEI). This initiative was aimed at encouraging R&D efforts through the provision of information and the transfer of technology. It was designed to be less costly and more targeted towards specific barriers to energy efficiency. It also stressed partnership arrangements with both provincial governments and the private sector so as to minimize duplication.

NCAEI was subsequently (in 1988) replaced by the Energy Efficiency and Diversity (EED) initiative, with funding of some $250 million over a five-year period. This program, currently in place, focuses on information, support for energy research and development, and demonstrations of existing and new technologies. It generally attempts to serve as a catalyst in the marketplace through a leveraging of the private sector and provincial support (in which public funding attracts other forms of support).

This is where the situation stood at the end of the 1980s. However, new pressures, chief among them the environmental question, forced the federal government to expand its involvement. The Federal Minister of Energy, Mines and Resources therefore instructed his officials to develop options to be included in a new Energy Efficiency and Alternative Energy Act. Such options must not bring about a major distortion of the free market and must be able to employ cost-effective technology. These were based on the proposals outlined in the government's Green Plan.

Precisely how and to what extent can government intervene? Various forms of intervention are possible, such as provision of information and the promotion of opportunities;

---

[7] Energy, Mines and Resources Canada, *Energy in Canada: A Background Paper*, November 1987, p. 90.

establishment of performance standards; incentive programs and changes to electrical utility pricing, and R&D. These possibilities will now be explored in greater detail.

A. Provision of Information/Promotion

It is generally recognized that government can play an important and effective role in providing information on energy efficiency. Over the years, EMR has provided consumers and manufacturers with up-to-date educational material and information. In the early 1980s, the government operated a toll-free information service ("The Heatline") to respond to inquiries on energy conservation and related federal assistance. More recently (in late 1990), the Department launched a national newspaper campaign to encourage consumers to reduce oil demand voluntarily, and introduced a toll-free number to provide expert advice on reducing consumption by using energy more efficiently.

The government's Green Plan contains a number of initiatives designed to provide consumers and firms with greater information. Chief among these is an enhanced Energuide labelling system, soon to be operational, which will provide information on energy consumption by household appliances. The application of the program to other appliances and products will follow, but this will be based on consultation with the provinces and industry.

EMR is also undertaking to improve the energy efficiency of Canada's transportation system by developing educational packages for managers of vehicle fleets and for drivers. Another initiative is the collection of statistics on the use of energy.

Turning to the important function of promoting certain products, processes and standards, the government is striving to meet energy efficiency objectives in a number of ways. Under the terms of the Measures for Energy Conservation in New Buildings initiative, the government is promoting the R-2000 energy-efficient standard in home construction and attempting to develop new opportunities for energy efficiency in new and renovated buildings.

The government is also working with industry to achieve improvements in energy efficiency. Two avenues are being explored: the sharing of information on new energy efficiency technologies and practices and the establishment of a National Advisory Council

designed to promote co-operation and, more important, to establish targets for improving efficiency performance, for each of our industrial sectors.

B. Performance Standards

Governments can also intervene through regulation. As part of its new focus on energy efficiency, the government is developing minimum energy efficiency standards for appliances and equipment. Products that do not qualify will be removed from the market. The federal government also intends to revise the 1983 Measures for Energy Conservation in New Buildings, and attempt to incorporate them into greater numbers of federal, provincial and municipal building codes.

In the transportation sector, the government intends to put into place tougher fuel efficiency targets for new vehicles. As the Environment Committee's report pointed out, substantial gains will be possible from raising the fuel efficiency of vehicles with internal combustion engines.[8]

In its review of standards, the Energy Options report acknowledged that appliance labelling and the imposition of tougher product standards for buildings and vehicles were appropriate means of prompting efficiency gains. It was also quick to point out, however, that they should be instituted as performance standards, as opposed to the putting in place of fixed, "command and control" regulation. This would provide firms and individuals with the flexibility needed to adopt the most cost-effective means of satisfying the regulatory requirement.

C. Incentive Programs

As was previously noted, financial incentives were a feature of the late 1970s and early 1980s, when the federal and provincial governments were providing vast sums of money to consumers, who it was felt had an important role to play in energy conservation. Essentially, these programs offered two forms of assistance: money in the form of loans, rebates or grants;

---

(8) House of Commons, Standing Committee on Environment, *Out of Balance: The Risks of Irreversible Climate Change*, March 1991, Table E, p. 32.

and technical assistance and advice. Examples are the Canadian Home Insulation Program (CHIP); the Canadian Oil Substitution Program (COSP); and Warm-Up Saskatchewan.

Owing largely to the cost of these programs and to deteriorating federal and provincial fiscal positions, the popularity of expensive subsidy programs has declined. Governments have been much more keen to adopt a market-based approach: to act in less costly but still effective ways to provide information and encouragement, and to regulate. The cost of these interventions should not be underestimated, however.

D. Reform of Energy Pricing

Probably the most effective way to generate efficiency gains would be to include in the price of energy the true cost of energy production and consumption, including environmental costs. Full cost pricing of energy sources would encourage least-cost energy solutions, such as those which help curtail energy use. After all, it makes sound economic sense to utilize cheap energy sources before expensive ones.

As the Minister of Energy, Mines and Resources observed, "if we conclude that the price of energy should be increased to reflect its true cost, energy efficiency will be the best way of retaining the advantage of inexpensive energy inputs."[9] The implication of this statement is that structural adjustment would, virtually by necessity, be undertaken to deal with the higher costs faced by consumers and businesses. Countries such as West Germany and Japan have undertaken these adjustments in the past; there is no reason why we in this country cannot as well.

One must, however, make note of the trade-off which has always existed in energy pricing policy. In some quarters, it is almost a given that access to secure and reasonably priced energy supplies is essential to economic growth and job creation. Therefore, it is argued that a balance needs to be achieved between economic and environmental objectives - that the ability of business to compete should not be compromised by sudden and massive

---

[9] Minister of Energy, Mines and Resources, Notes for a speech to the 12th Canadian National Energy Forum of the Canadian Member Committee of the World Energy Council, Toronto, 5 November 1990, p. 2.

increases in energy costs. The problem with this reasoning, however, is that it is precisely these sudden shocks that are likely to bring about the greatest investment in efficiency-enhancing materials, equipment, buildings and processes. The price signal is an important tool to effect change, change which in its own right is economic and will provide distinct long-term advantages.

E. Towards a Level Playing Field

The fact that federal energy policy has, since the mid-1980s, been touted as being market-driven has not stopped the government from providing subsidies and tax concessions to proponents of megaprojects and to firms active in oil and gas development and nuclear operations. It has also, however, been lowering its financial support for energy efficiency and conservation programs. The federal government's spending for energy supply programs is calculated to have exceeded that devoted to energy conservation and renewable sources of energy by a factor of 23.[10]

This imbalance results in a distortion in the economy's allocation of resources between energy options. Measures to rebalance existing funding and support mechanisms would go far to enhance the competitive edge required by firms active in energy efficiency.

F. Management of Its Own Asset Base

The federal government manages a large stock of public buildings, vehicles and equipment, which together consume significant amounts of energy. To show leadership by example, and as a response to recent developments in the Persian Gulf, the government initiated a Demand Side Management (DSM) program for its own buildings. Under a Letter of Cooperation signed by two Ministers and Ontario Hydro in March of this year, the provincial utility will conduct energy efficiency audits of a minimum of 1,300 federal facilities in the province each year for the next five years. The federal government anticipates annual savings

---

(10) The Rawson Academy of Aquatic Science, *Environmental Evaluation of Federal Energy Expenditures*, April 1991, p. 9.

of between $25 and $50 million in its energy bill, if all of the buildings in Ontario implement the full range of energy-saving measures identified in pilot projects.

Programs such as this can generate a number of important benefits for the government, once the initial capital costs have been digested. These would include a lowering of energy costs and a reduction in CO_2 and other greenhouse gas emissions.

G. Research and Development

By the early 1980s, Canada had developed a sizeable energy research, development and demonstration program, which placed considerable emphasis on technologies designed to conserve energy and those which promoted the use of alternative energy sources. Throughout the 1980s, much of this work in the non-conventional use of energy was wound down, with the result that federal government funding for conservation and renewable energy R&D in the fiscal year 1990-91 was a mere one-third (in current dollars) of the support provided in the early 1980s. Since 1984, funding of energy efficiency R&D programs has been reduced substantially, for a number of reasons: federal budget constraints, a smaller degree of overall government intervention in the energy sector, and a sharp diminution in society's concern with the security of energy supplies, given the glut of low-priced crude on world markets.

At present, the government's involvement in R&D is through two programs launched in 1988: the Energy Efficiency and Diversity Initiative (EED) and the Energy Research and Development Program (ERDP). All told, over $600 million was committed to be spent over a five-year period (1988-89 to 1992-93).

The federal government has been leery of spending much in the way of money; instead, it prefers to leverage funding from the private sector and the provinces. Its support for R&D in the area of efficiency and alternative energy also pales in comparison with its R&D spending on fossil fuels, for example.[11]

---

(11) According to a recent comparative review by the IEA of countries' energy policies, the Canadian government's funding of the former category accounted for 9.5% of total R&D funding on energy, versus 79% on the fossil fuels.

Energy efficiency research currently supports the development and use of technologies that contribute to more efficient use of energy in the industrial, commercial and business sectors. Much of this technology-related work is undertaken at EMR's CANMET laboratories and in co-operation with industry through joint contract work. CANMET is devoting a great deal of attention to enhancing the efficiency of domestic gas furnaces (increase in efficiency of between 30-35%) through conversions of conventional units to condensing furnaces. Efforts are also underway to develop improved high efficiency furnaces with plastic heat exchangers, high-efficiency instantaneous water heating units and combined space and water heating systems. CANMET is also attempting to ameliorate the efficiency of industrial combustion processes.

The new-found emphasis on the environment has prompted a new focus on the efficiency-related R&D budget of the federal government. It is generally accepted that if this country is to achieve substantial progress in improving efficiency (e.g., 2% improvement per year over a ten-year period), greater funding of R&D is needed. That is the message from the report of the Environment Committee on global warming (the federal government should "considerably increase" its support for R&D for efficiency) and that is also the objective of the government.

The government's own Green Plan contains a number of initiatives involving R&D. Broken down by sector, these are: the development and commercialization of new technologies for energy-efficient buildings (e.g., improved windows, lighting, heating/cooling); the identification and development of technologies applicable to improving efficiency in various industrial sectors; and the training and certification of energy efficiency managers in industrial companies. While a dollar amount was not assigned in the Green Plan to the new R&D thrust, the Minister of Energy, Mines and Resources did announce that the government would boost spending on research into alternative fuel sources and energy efficiency by between $150 million and $200 million over the next five or six years. An increase in the R&D budget of this magnitude could help stimulate new technologies as well as industrial opportunities, and enhance exports.

H. Contribution of Electrical and Natural Gas Utilities

It has become apparent to a number of major electricity-generating utilities that, even without internalizing environmental costs, it is more cost-effective to persuade customers to reduce electricity consumption than to build a new generating facility to meet increased demands. This has led these utilities to emphasize the conservation of electrical energy and, to a lesser extent, natural gas energy. Ontario Hydro and B.C. Hydro are two utilities that have committed themselves to spending hundreds of millions of dollars in energy conservation measures. These range from promotions of compact fluorescent light bulbs for residential customers, through financial support for the purchase of high efficiency motors, to support for gas co-generation projects to reduce the need for further investments in generation and transmission.

There may be a need for the utilities to become even more aggressive, however, perhaps through the adoption of energy efficiency codes and standards and greater employment of their large R&D facilities. As was mentioned above, changes in electrical utility pricing and accompanying provincial regulatory structures may also be useful. It could be advisable for provincial utilities to look at potential efficiency gains when setting electricity prices and planning capacity additions. By modifying the demand for electricity, the utilities can postpone the construction of environmentally-destructive projects and avoid surges in their capital accounts.

Canada has a full range of proven energy efficiency and load management technologies. DSM technologies such as energy-efficient lighting and high efficiency motors can bring about major reductions in the consumption of electricity, and in the process achieve both economic and environmental benefits. For its part, the Canadian Electrical Association's members have plans to invest more than $8 billion in energy efficiency and load management programs, with the objective being to save 14,000 MW of electrical capacity.[12]

Critics of these spending plans, such as Energy Probe for one, argue that utilities should not be in the business of paying individuals to use less energy. These effects, it is noted,

---

(12) Minister of Energy, Mines and Resources, Notes for a speech to the Western Regional Conference on Demand Side Management of the Canadian Electrical Association, 17 May 1990.

result in a simultaneous increase in the utilities' costs and a decrease in its revenue. The higher costs are inevitably carried by all consumers, even those not benefiting from the subsidy programs. Instead, energy savings programs should be guided by market signals, such as higher electricity rates, which would, for example, include all environmental and social costs. Of course, due regard would have to be given to the impact of higher rates on the international competitiveness of our high energy using industries.

While the electrical utilities are determined to undertake DSM initiatives, the efforts of natural gas utilities in this area have not been as evident. To help stabilize CO_2 emissions and reduce our energy intensity, these utilities are under pressure to focus more on DSM on top of the information that they provide on energy-saving techniques such as the upgrading of insulation, caulking and weatherstripping, use of programmable thermostats, and so on.

To this end, the federal government has set up a joint task force with the Canadian Gas Association to assess the potential for DSM in the natural gas industry. The Minister of Energy, Mines and Resources wants the industry to follow the lead of the electrical utilities, although he recognizes the existence of certain technical difficulties in attaining this objective.

CONCLUDING REMARKS

The primary purpose of this paper has been to serve as a primer on the motivations for enhancing energy efficiency in Canada, as well as for the prospects and problems associated with that effort. Three themes can be highlighted. Given the many economic and environmental advantages of a more rigorous focus on energy demand, it is important that firms and consumers do their utmost to minimize the use of energy resources. One must not, however, lose track of the need to achieve overall economic efficiency, even if this means using slightly higher than desirable amounts of energy to reduce total financial costs. This can in no way be construed as wasting our economic resources.

A second point is that, while a number of studies have verified significant potential for cost-effective investments in energy efficiency, much of this potential continues to

be off limits to the market. The numerous current barriers to improved efficiency must be removed. Here, there is a role for government, albeit not a punitive one.

Finally, and perhaps most significantly, the driving force behind the new-found impetus for energy efficiency is the concern over environmental issues. If this concern is to be translated into concrete policy action, every effort must be made to ensure that the steps taken are effective both in terms of the environment and our need to maintain our international competitiveness. The review of the economic potential of energy efficiency investments reveals sectoral opportunities which, if properly captured, can be satisfactory on both counts.

BIBLIOGRAPHY

Baker, Barbara D. and Ellen F. Battle. *Demand-Side Management for Electricity: Pushing Back Barriers*. Canadian Energy Research Institute, Study No. 43, March 1992.

Energy, Mines and Resources Canada. *Economics of Energy Conservation in Canada*. Economic and Financial Analysis Division, 1984.

Energy, Mines and Resources Canada. *Energy Use and Atmospheric Change*. Efficiency and Alternative Energy Branch, August 1990.

Energy Options Advisory Committee. *Energy and Canadians into the 21st Century*. August 1988.

Government of Canada. *Canada's Green Plan*. Minister of Supply and Services Canada, Cat. No. En 21-94/1990E, 1990.

International Energy Agency. *Energy Conservation in IEA Countries*. Organisation for Economic Co-operation and Development/IEA, Paris, 1987.

McLachlan, Michele and Imad Itani. *International Comparisons: Interpreting the Energy/GDP Ratio*. Canadian Energy Research Institute, Study No. 41, December 1991.

Peat, Marwick, Stevenson and Kellogg. *The Economically Attractive Potential for Energy Efficiency Gains in Canada*. Report prepared for Energy, Mines and Resources Canada, Toronto, May 1991.

ACCO®

ACCOPRESS™M.C

YELLOW	25070	JAUNE
*BLACK	25071	NOIR*
*BLUE	25072	BLEU*
RL. BLUE	25073	RL. BLEU
*GREY	25074	GRIS*
GREEN	25075	VERT
RUST	25078	ROUILLE
EX RED	25079	ROUGE

ACCO CANADA INC.
WILLOWDALE, ONTARIO

* INDICATES 75% RECYCLED 25% POST-CONSUMER FIBRE

*SIGNIFIE 75 % FIBRES RECYCLÉES, 25 % DÉCHETS DE CONSOMMATION

BALANCE OF PRODUCTS 25% RECYCLED

AUTRES PRODUITS: 25 % FIBRES RECYCLÉES